The Lightness of Being

Physics Opens a Door to a Theory of Consciousness

Dr. Joachim Keppler, January 2012
1 Introduction to Consciousness

2 Physics: Unsolved Problems and Promising Solutions

3 Link between Physics and Consciousness
Definition of Consciousness

Conscious experiences are associated with qualitative feels, i.e., consciousness is connected with phenomenal qualities (qualia):

- Sight
- Smell
- Touch
- Taste
- Hearing
- Emotions

first-person aspects of the mind = inner world
The Hard Problem of Consciousness

- Fundamental questions
  - How can a physical system give rise to conscious experience?
  - How can a physical theory incorporate the existence of consciousness?

- In “western thinking” these problems are hard to solve because we believe that …
  - a physical system “produces” consciousness,
  - the functioning of our bodies would be possible without conscious experience.

- Do robots have conscious experience?
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# The Floor Plan of Physics

**Classical physics**
- Mechanics
- Electrodynamics
- Newton laws
- Maxwell equations

**Quantum mechanics**
- Dirac / Schrödinger equation
  - (wave functions, probabilities)

**Special relativity**
- Lorentz transformation
- Energy-mass relation

**General relativity**
- Einstein equations
  - (curved space-time)

**Quantum field theory**
- QCD
- GSW
- QED

**Cosmology**
- Big bang theory
- Inflationary universe

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### Unsolved Problems and Open Questions of Physics

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<th>Mechanics</th>
<th>Electrodynamics</th>
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<td>Grand unification?</td>
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Understanding the vacuum

Derive a consistent theory of physics from the structure of the vacuum

Goal of Stochastic Electrodynamics (SED)
Two Different Philosophies of Creation

- **Creation** = generation of phenomena out of nothing
  selective population of the vacuum (void)

- **Creation** = filtering of phenomena out of an infinite potential
  selective restriction of the plenum

Our world is based on the second philosophy of creation!
Genesis - The Absolute

Plenum

Pure potential / energy / dynamics

Infinite sea of light / all-pervasive radiation field (ZPF)

Perfect symmetry: homogeneity, isotropy, Lorentz invariance, scale invariance

\[ E_{ZP}(r,t) = \sum_{\lambda=1}^{2} \int d^3k \left( \frac{\hbar \omega}{2 \pi^2} \right)^{1/2} \varepsilon(k,\lambda) \cos(k^*r - \omega t + \theta(k,\lambda)) \]

\[ B_{ZP}(r,t) = \sum_{\lambda=1}^{2} \int d^3k \left( \frac{\hbar \omega}{2 \pi^2} \right)^{1/2} (k \times \varepsilon(k,\lambda)) \cos(k^*r - \omega t + \theta(k,\lambda)) \]
Genesis - Polarization of the Absolute

Polarization of the plenum

Creation of the relative

Creation of space-time and charges (vortices of light)

Process not well understood yet (charge quantization, pre-elementary particles)
Genesis - Selective Restriction of the Absolute (1)

Selective restriction of the plenum

Level 1: elementary particles → creation of mass

Localized energy associated with charge oscillation driven by the ZPF

Filter function: $\eta(\omega)$ with resonance at $\omega = \omega_c$

Energy density: $\rho_{ZP}(\omega) = \frac{\hbar \omega^3}{2 \pi^2 c^3}$

$E = V \int \eta(\omega) \rho_{ZP}(\omega) \, d\omega$

$m_0 = \frac{V}{c^2} \int \eta(\omega) \rho_{ZP}(\omega) \, d\omega$
Genesis - Selective Restriction of the Absolute (2)

Selective restriction of the plenum

Level 1: elementary particles → creation of inertia

Particle feels asymmetry of the ZPF → non-zero radiation pressure

\[ F = - \left( \frac{V}{c^2} \int \eta(\omega) \rho_{ZP}(\omega) d\omega \right) a \]

\[ = - m_i a \quad \rightarrow \quad m_i = m_0 \]

Distortion (asymmetry) of ZPF in the vicinity of matter is the origin of gravity → equivalence principle
Genesis - Selective Restriction of the Absolute (3)

Selective restriction of the plenum

Equilibrium: \( P_{\text{rad}} = P_{\text{abs}} \)

Level 1: elementary particles → creation of stability

Resonance

Compton frequency: \( \omega_c \)

Spin quantization: \( s = \hbar/2 \)

\[ m \ddot{r} = \frac{2}{3} \frac{e^2}{c^3} \dot{r} - e \left( E_{\text{ZP}}(r,t) + \frac{v}{c} B_{\text{ZP}}(r,t) \right) \]
Genesis - Selective Restriction of the Absolute (4)

Selective restriction of the plenum

Level 2: atoms → creation of stability

Equilibrium: $P_{rad} = P_{abs}$

Resonance

Bohr radius: $R = R_{Bohr}$

Quantization of energy levels: $m \nu R = n \hbar$

$m \ddot{r} = -\frac{e^2 r}{|r|^3} + \frac{2 e^2}{3 c^3} \ddot{r} - e \left( E_{ZP}(r,t) + \frac{\nu}{c} \times B_{ZP}(r,t) \right)$
Selective restriction of the plenum

Level 2: atoms → creation of form

Structure of atoms is governed by the ZPF

Orbitals are stable attractors of a stochastic interaction process
Genesis - Selective Restriction of the Absolute (6)

Selective restriction of the plenum

Level 3: molecules → creation of form

3-dimensional conformation of molecules is governed by the ZPF

Interaction between molecules (van der Waals force) is also governed by the ZPF
Genesis - Universal Mechanism of Structure Formation

Structure builds up hierarchically through selective filtering of the ZPF

- Free ZPF
  - Quantization of spin and mass
  - Quantum behavior results from interaction between ZPF and matter (balance condition)
  - New properties emerge on each hierarchical level (basis of diversity and complexity)
  - On each level stationary states (= stable attractors) arise
  - Self-similarity of nature is due to scale-invariance of the ZPF

- Macroscopic quantum phenomena
- Plenum
  - Elementary particles
- Atoms
- Molecules
- Macroscopic systems

Quantization of atomic levels
Quantization of molecular levels
Study simple nonlinear system driven by the ZPF:

\[ \ddot{x} = -\omega_0^2 x - \beta x^2 + \tau \dot{x} + \frac{e}{m} E_{ZP}(t) \quad \text{with} \quad E_{ZP}(t) = \int d\omega \tilde{E}(\omega) e^{-i\omega t + \theta(\omega)} \]

ZPF is modified as soon as the system reaches a stable attractor:

- Relevant frequency components involved in the maintenance of the equilibrium become highly correlated (“de-randomization”)
- Different attractors are associated with different ZPF configurations
Genesis - Summary

Absolute (plenum)

Polarization of the plenum

Transformation of potential into realization / manifestation

Pure potential

Structures leave imprints (information states) in the plenum

Creation of the relative

Arena of our cosmos

Creation of structure

Selective restriction of the plenum

Levels of stability / complexity
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## Comparison between Physics and Eastern Philosophy

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<th>Physics (SED)</th>
<th>Eastern Philosophy (Buddhism)</th>
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<tr>
<td>1. The universe is based on an all-pervasive radiation field (ZPF) exhibiting infinite potential and energy.</td>
<td>1. The universe is formed out of an infinite potential (Prana). Everything is produced by this primordial energy.</td>
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<tr>
<td>2. All phenomena result from selective restriction of the ZPF and dynamic interaction between the ZPF and matter.</td>
<td>2. All phenomena spring forth from Prana through a transformation process, a dynamic flow of interactions.</td>
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<tr>
<td>3. Nothing exists on its own. The properties of matter are not intrinsic, but acquired in an interaction process.</td>
<td>3. Phenomena have no intrinsic existence (emptiness). The properties of matter are caused by interdependence.</td>
</tr>
<tr>
<td>4. The ZPF shapes matter and matter shapes the ZPF. This interplay gives rise to information states in the ZPF.</td>
<td>4. Consciousness shapes matter and matter shapes consciousness. Mind and matter are composed of the same primordial energy.</td>
</tr>
<tr>
<td>5. All forces of the universe are mediated by the ZPF, i.e., local modifications and distortions of the ZPF result in forces.</td>
<td>5. All forces of the universe are modifications of Prana, also those of the human mind from consciousness to the subconscious.</td>
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The Relationship between Brain and Consciousness

- There is an implicit unity of primordial energy and primordial consciousness.
- The ZPF is an appropriate candidate for the substrate of consciousness.
- Our individual consciousness is the result of an interaction (filtering) process which causes the realization of information states in the ZPF.

Diagram:

- Primordial consciousness (ZPF)
- Information states in the ZPF
- Qualia and memories

Information transfer:

- Consciousness influences brain
- Brain / neural activity modifies substrate of consciousness
References
